CLAIMS

What is claimed is:

1. A method of treating a surface of a substrate, the method comprising:

(a) forming hydroxyl groups on an oxide surface by exposing the surface to a plasma;

(b) reacting a first gas comprising epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide surface-bound spacer chains.

2. The method of claim 1, further comprising immobilizing biomolecules on the surface by reacting the biomolecules with the surface-bound spacer chains.

3. The method of claim 2, wherein the biomolecules are amine-functionalized or amine-containing biomolecules.

4. The method of claim 1, wherein the oxide surface comprises a silicon oxide.

5. The method of claim 4, wherein the oxide surface comprises silica, glass or quartz.

6. The method of claim 1, wherein the oxide surface comprises a metal oxide.

7. The method of claim 6, wherein the metal oxide comprises a native oxide of stainless steel.

8. The method of claim 1, wherein the plasma is formed from a source gas comprising water, oxygen or a mixture thereof.

9. The method of claim 1, wherein the epoxy-functional molecules are epihalohydrin molecules.

10. The method of claim 9, wherein the epihalohydrin molecules are epichlorohydrin molecules.

11. The method of claim 1, wherein the epoxy-functional molecules are diepoxide molecules.

12. The method of claim 11, wherein the diepoxide molecules are 1,4-butanediol diglycidyl ether molecules.

13. The method of claim 2, wherein the biomolecule is selected from the group consisting of oligonucleotides, aptamers, cDNA and RNA.

14. The method of claim 2, wherein the biomolecule is a protein.

15. The method of claim 1, further comprising extending the spacer chains by reacting the spacer chains with spacer molecules *in situ* in the absence of plasma to provide extended spacer chains.

16. The method of claim 15, wherein the spacer molecules comprise an amine group capable of reacting with the epoxy functionality of the spacer chains.

17. The method of claim 15, still further comprising immobilizing biomolecules on the extended spacer chains by reacting the biomolecules with the extended spacer chains.

18. An inorganic oxide substrate comprising:

(a) an inorganic oxide substrate surface;

(b) one or more molecular spacer chains covalently bound to the surface, the one or more spacer chains having a length of at least 2.5 nm; and

(c) one or more biomolecules covalently bound to the one or more molecular spacer chains.

19. The substrate of claim 18, wherein the substrate surface comprises an inorganic oxide selected from the group consisting of glass, silica and quartz.

20. The substrate of claim 18, wherein the substrate surface comprises a metal oxide.

21. The substrate of claim 20, wherein the metal oxide is a native oxide of stainless steel.

22. The substrate of claim 18, wherein the one or more spacer chains have a length of at least 4 nm.

23. The substrate of claim 18, wherein the one or more spacer chains have a length of at least 5 nm.

24. The substrate of claim 18, wherein the one or more biomolecules are proteins.

25. The substrate of claim 18, wherein the one or more biomolecules are enzymes.

26. The substrate of claim 18, wherein the one or more biomolecules are oligonucleotides.

27. A method of treating a surface of a substrate, the method comprising:

(a) implanting silicon-chlorine functionalities into the substrate surface by exposing the surface to a chlorine-containing plasma;

(b) forming hydroxyl groups on the surface by exposing the silicon-chlorine functionalities to a gas comprising water, oxygen or a mixture thereof; and

(c) reacting a gas comprising epoxy-functional molecules with the surface hydroxyl groups *in situ* in the absence of plasma to provide surface-bound spacer chains.

28. The method of claim 27, wherein the chlorine-containing plasma is ignited from a gas selected from the group consisting of dichlorosilane, silicon tetrachloride, hexachlorodisilane and mixtures thereof.

29. The method of claim 27, wherein the epoxy-functional molecules are epihalohydrin molecules.

30. The method of claim 27, wherein the epoxy-functional molecules are diepoxide molecules.

31. The method of claim 27, further comprising immobilizing biomolecules on the surface by reacting the biomolecules with the surface-bound spacer chains.

32. The method of claim 27, further comprising extending the spacer chains by reacting the spacer chains with spacer molecules in situ in the absence of plasma to provide extended spacer chains.

33. The method of claim 32, further comprising immobilizing biomolecules on the extended spacer chains by reacting the biomolecules with the extended spacer chains.